PLASMA FRACTIONATION; PAKISTAN'S POTENTIAL

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ABSTRACT

Plasma, the liquid portion of blood, is rich in various types of proteins, hormones and enzymes, each playing its vital and most of the time, irreplaceable role in the healthy sustainment of life. Plasma Fractionation is the separation of the desired therapeutic plasma proteins from the unnecessary ones. Various countries have established their own plasma fractionation projects that reduce this cost and make the countries self sufficient in their requirements of the plasma derived medicines. Pakistan has a high demand of plasma derived medicines and the establishment of a national plasma fractionation project through contract mechanism is a good model. Considering the currently weak overall infrastructure of health care system and blood transfusion services, some important recommendations include centralized blood transfusion and a pilot contract fractionation resulting in self self-sufficiency in plasma derived medicines.

KEYWORDS*: Fractionation, Plasma, Transfusion, Pakistan*

INTRODUCTION

The liquid portion of human blood, the plasma, constitutes about 55 percent by volume of total human blood. Plasma is rich in various types of proteins, hormones and enzymes. Plasma fractionation is the separation of required therapeutic plasma proteins from other constituents of plasma while ensuring that the process does not harm the harvested components. The ability to fractionate plasma represents a great advancement in the medical science. The fractionation process fundamentally involves pooling, purification and processing of donated plasma. The manufacture and use of plasma products was originally developed by E.J. Cohn [1] during World War II, in an effort to reduce war mortalities. In 1964, Judith Pool developed a simple way to make cryoprecipitate that contained factor VIII. This discovery was a revolutionary treatment for the haemophilia patients. Since then, medical use of the plasma products has increased markedly along with the improvements and advances in plasma fractionation techniques. The fractionation products are mostly used for replacement of missing or deficient component(s) in blood of individuals with some rare and serious life threatening conditions, like immunodeficiencies and bleeding disorders. Treatment with the required plasma product saves the life of these individuals and helps them lead normal lives. Many of the plasma derived medicines have also been enlisted in the World Health Organization's 'Model List of Essential Medicines'. [2]

About 23–28 million liters of human plasma are fractionated every year in 70 fractionation plants globally, out of which about 35% is processed from whole blood donations and 65% by plasmaphaeresis.[3] These fractionation plants have a capacity to fractionate 50,000[4] to 6 million[5] litres plasma. International market for plasma derived medicines is very vibrant increasing by about 10% every year. In 2008, the global market for plasma products

reached $11.8 billion, a 69% increase from 2005, intravenous immunoglobulins (IVIG) being the most in demand plasma product with 29% share. IVIG is the driver of plasma need in western countries while coagulation factors are driver of plasma need in developing countries. In Norway, the fractionation project generated large revenues and the total profit from the products produced was 140 € per liter plasma.[6] The United States, with 70% of the total global plasma collections, is completely independent to meet its requirements as well as being self-sufficient in the full range of plasma products.[7]

Countries that do not have proper infrastructure for fractionation projects enter into 'Contract Fractionation'. This causes significant savings on national health expenditure and also serves to improve national blood safety. In this arrangement, plasma is collected locally, processed in an independent facility located abroad and refined products are returned to the country. A minimum of 30,000 to 50,000 litres of plasma is required for contract fractionation.[5] Cost effectiveness is the main advantage of contract fractionation as capital investment (at least US $50-100 million) [5] on manufacturing plant is saved. The blood transfusion services of the respective country collect plasma from voluntary donors through strict selection criteria, serological screening and quality assured processing and storage of plasma. On the other hand, the fractionator has to guarantee the maximum yield of quality products by following GMP (good manufacturing practices).

In Asia, Iran entered into contract fractionation in 2004 [8] and exports 100,000 liters of plasma to Europe every year supporting the healthcare services through the availability of plasma related medicines. [9] India, Japan, South Korea and China have attained self-sufficiency in plasma medicines with two, four, two and thirty domestic fractionation plants respectively. Hong Kong, Malaysia and Singapore rely on contract fractionation. [10] The potential therapeutic plasma market of the Asian countries like Singapore, Malaysia and Thailand has been estimated to be $100 million, $470 million and $1.2 billion respectively. [11] Based on these figures, the potential of Pakistan, with 190 million inhabitants, is estimated to be $ 3.2 – 3.6 billion.

World Health Organization has published several recommendations for the collection of plasma for fractionation [12] to increase the availability of safe plasma-derived products. This is done by supporting the implementation of national validated standards of quality and safety for blood establishments and enables them to produce qualified human plasma for fractionation. [3]

Pakistan, with a population of more than 190 million, is located in South Asia. The health care system in Pakistan faces numerous challenges, such as structural fragmentation, scarcity of resources and ineffective service delivery. The private sector contributes about 70% of the health care services provided. The overall health regulatory framework in the country is poor and inadequate, however, neither private nor non-government sectors work within a regulatory framework.[13] This system is weak as a whole and needs to be strengthened at all levels. The government is spending 3.5% of the GDP on health [14] which includes the import of costly medicines, many of which can be manufactured locally through plasma fractionation. Due to the widespread practice of whole blood transfusion, plasma is not separated from the cellular components, but the recent trend of developing blood components is changing the scenario. The fragmented blood transfusion system is, however, a barrier in the promotion of plasma fractionation in the country.

In Pakistan, the blood services are provided mostly by hospital blood banks with no functional separation of the processes into production and utilization. A considerable proportion of blood establishments are operating outside any formal registration and documentation framework, so that the actual number of blood establishments is not

known but it is estimated that on the whole a total of 1830 blood centres, with a significant contribution from the private and NGO sector.[15] In addition to the private sector, several blood donor organizations are operating at various levels from online donor database to full fledge transfusion services including a thalassaemia centre.

Contract fractionation is not possible in the current transfusion system where the concept of voluntary blood donation, which is the first prerequisite to safe blood transfusion and hence fractionation, is uncommon. The donation system is replacement based and relatives and friends are under pressure to donate for their patient.
As there is no regulatory set up, every institution has evolved its own style of work and safety which puts the consumer/patient at risk. The Government has taken initiatives to regulate the system and to achieve the objective of blood safety through blood safety system reforms which include the establishment of Blood Transfusion Programmes at the federal, provincial and state level and the development of 13 Regional Blood Centres as 'production units' and 78 Hospital Blood Banks as 'consumption units' in the first phase and covering the entire country eventually. This regionally centralized model will ensure quality practices at every step of vein to vein transfusion chain. The annual collection capacity of the 13 Regional Centres will be 440,000 units. It is anticipated that the new state of the art Regional Blood Centres will rely on voluntary blood donor system with proper documentation and a regular follow-up of donors through a management information system. The possibility of contract fractionation in plasma collected in these centres functioning under the new system is worth exploring.

This national level plasma fractionation project can lead to attainment of self-sufficiency in plasma-derived medicines. The Government commitment is crucial to the success of the proposed plasma fractionation project by establishing policies (on blood donations and plasma products)[16] and legal and regulatory framework. Large partners in the private sector performing quality work, with annual collections in excess of 50,000 units may be considered as regional centres and included in this plasma fractionation project as public private partnership.

CONCLUSION

The project is expected to result in availability of plasma derived medicines which are hitherto unavailable to a vast majority of population. In addition, the project would contribute to improvement in quality of blood transfusion services and products.

COMPETING INTERESTS

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